NESTING OF THE SNOWY PLOVER IN THE MONTEREY BAY AREA, CALIFORNIA IN 2013

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SYNOPSIS

Researchers and associates of Point Blue Conservation Science (Point Blue), the U.S. Fish and Wildlife Service (USFWS), and the California Department of Parks and Recreation (CDPR) monitored nesting Snowy Plovers at Monterey Bay in Monterey and Santa Cruz counties in 2013 to assess the plover's response to management efforts by the government agencies to enhance the species' breeding success and increase its population size. Management actions undertaken by federal and state agencies included:

- Roping-off upper beach and riverine spit habitat to minimize disturbance to nesting birds by the public.
- Exclosures to protect individual nests from predators when needed (Table 1).
- Predator removal by the Wildlife Services Division of the U.S. Department of Agriculture (USDA).
- Water management to provide nesting and feeding habitat in the managed ponds of the Moss Landing Wildlife Area (MLWA).

The estimated 382 plovers that nested in 2013 was a similar number to the 386 that nested the previous year (Fig. 1) and greater than the target of 338 breeders recommended for the Monterey Bay area in the USFWS Recovery Plan. No plovers were detected nesting on northern Santa Cruz County pocket beaches for the fourth consecutive year. The 2013 nesters consisted of 199 males and 183 females all of which were uniquely color banded except for 10 males and 17 females which were unbanded. Among the uniquely color marked breeders were 15 males and 30 females produced from nesting attempts in the Monterey Bay area in 2012.

Return rates of breeders were slightly above average in 2013. Of color banded adults that nested in 2012, 72% of both males and females returned and bred in 2013. This compares with average return rates of 68% for males and 63% for females in the prior 14 years (Fig. 2).

We found 482 nests and 17 broods from undetected nests indicating at least 499 nesting attempts in the Monterey Bay area in 2013 (Table 2). The 2013 beach and pond clutch hatching rates were substantially below their respective averages from 1999-2012. The 31.5% hatching rate on the beaches was 50% below the 63% average of the previous 14 years and the salt pond rate of 5.3% was 92% below the 70% average of the previous 14 years (Fig. 3).

Predators were likely responsible for at least 63% of the 340 nest losses in 2013 (Tables 3 and 4). Of the 215 losses attributed to predators, 57.7% were attributed to avian predators, 11.2% to mammalian predators and 31.2% to unknown predators. Ravens, harriers, gulls and a Red-tailed Hawk were the avian species identified depredating nests (Table 4). Skunks, canines, and raccoons were deemed responsible for 22 of the 24 nest losses attributed to mammalian predators (Table 4). Three nests categorized as lost at hatch were undoubtedly also destroyed by avian or mammalian predators but we could not be sure if the losses occurred in the egg or chick phase.

Among nest losses attributed to other causes were 1 nest destroyed by humans and 15 by natural elements such as wind, tide and rain (Table 4). Ten nests were deserted and 1 had non-viable eggs. No cause of loss could be attributed for 27.6% of the 340 nests that failed but most of these were probably taken by predators rather than other causes listed in table 4. The fate of only one nest was categorized as unknown (Table 4).

Chick fledging rate was also considerably below average in 2013. Only 28-30% of the chicks fledged on the beaches in 2013; this was about 30% below the average of 41.5% from 1999-2012 (Fig. 4). The chick fledging rate for the ponds was 0.0% for the 5 chicks that hatched there. On average 49 chicks have fledged in the salt ponds since 1999.

The total of 116 fledged young for the Monterey Bay area was 51% below the 236-bird average from 1999-2012 and marked the fourth year of decline since 2009 (Fig.5). The number of fledglings from the beaches was 37% below the prior 13-year 185-bird average. Most young that fledged in 2013 were from south bay beaches (Table 4).

The 2013 fledging rate of 0.58 young per male was 59% lower than the 1.4 bird average of the past 14 years (Fig. 6), was the fourth year of a steady decline (Fig. 6), and was well below the level of one young per male needed to prevent the population from declining (USFWS Recovery Plan).

The consequence of the low number of fledglings in 2013 will likely be a smaller breeding population in the Monterey Bay area in 2014.

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INTRODUCTION

Staff and research associates of Point Blue Conservation Science (formerly PRBO), with the assistance of staff and/or interns of the U.S. Fish and Wildlife Service and the California Department of Parks and Recreation, have monitored nesting Snowy Plovers annually on the shores of Monterey Bay since 1984, and on small pocket beaches in northern Santa Cruz County since 1988, to assess the number of breeding plovers, number of nests, clutch hatching rate, chick fledging rate, and causes of egg and chick loss. Here we summarize the results of the monitoring effort in 2013.

STUDY AREA

The study area includes the beaches of Monterey Bay, former salt ponds in Elkhorn Slough (hereafter Salt Ponds), and pocket beaches in northern Santa Cruz County. For reporting purposes we divide up the study area as follows:

Monterey Bay Area

South Beach Subregion

Del Monte: Beach between the City of Monterey and Tioga Road, Sand City. Most of it is adjacent to Sand City. The beach is managed by CDPR.

Sand City: Beach between Tioga Road, Sand City and the south boundary of Fort Ord.

South Fort Ord: Beach between the south boundary of Fort Ord and the site of former Stilwell Hall. It is managed by CDPR.

North Fort Ord: Beach between Stilwell Hall site and the Lake Court beach access to Marina State Beach. It is managed by CDPR.

Reservation Road: From the Lake Court beach access for Marina State Beach to Reservation Road. It is managed by CDPR.

Marina: The entire beach from Reservation Road to the Salinas River National Wildlife Refuge. It is managed by CDPR and the Monterey Peninsula Regional Park District. It is subdivided into four segments, all of which are completely or partly bordered by private property (Table 1).

Salinas River National Wildlife Refuge: The entire beach on the Salinas River National Wildlife Refuge (NWR), which is owned and managed by USFWS.

Salinas River North: The entire beach from the Salinas River NWR (or north of the Salinas River mouth) to the mouth of Elkhorn Slough. It is owned and managed by CDPR. It is further divided into three segments – the north spit of the Salinas River, Monterey Dunes, and Molera/Potrero road segments (Table 1). The Monterey Dunes segment is backed by a beach front housing development. The Molera/Potrero segment

is backed by dunes, the Old Salinas River channel, salt marsh, and, east of the river channel, by agricultural fields south of and by development north of Portrero Road.

North Beach Subregion

Jetty Road to Beach Road: All the beach between Jetty Road (mouth of Elkhorn Slough) and Beach Road. It is divided into 3 segments all managed by CDPR (Table 1). The north end of the Pajaro spit is bounded by a beach front development.

Sunset/Manresa: The entire beach from Beach Road to the north boundary of Manresa State Beach. The south end of this subregion is backed by a beach front development. The beach is managed by CDPR.

Salt Pond Region

It includes approximately half of the former salt ponds in Elkhorn Slough that have been converted to managed, diked wetlands and are now encompassed within the California Department of Fish and Wildlife's (DFW) Moss Landing Wildlife Area.

Northern Santa Cruz County Pocket Beach Region

We sporadically covered the four beaches known to have formerly supported nesting Snowy Plovers in northern Santa Cruz County. ***Wilder Creek Beach*** and ***Laguna Creek Beach*** are owned and managed by CDPR. ***Scott Creek Beach*** is owned and managed by the County of Santa Cruz and ***Waddell Creek Beach*** is owned by the CDPR and by a private party.

MONITORING

We attempt to find all plover nests initiated in the study area. Unique color band combinations are used to individually mark plover adults and chicks. For color banding, adults are usually trapped on the nest. Chicks are captured in or near the nest at the time of hatching. Clutch hatching dates are estimated from egg laying dates, when known, or from egg flotation. They are further refined by examination of eggs for cracked shells, tapping chicks, or peeping chicks just before the estimated hatching date. Chicks are considered fledged if they survive 28 or more days after hatching. Monitors look for fledglings when they have reached 28 days of age by watching banded males known to have broods and by monitoring flocks of roosting plovers during the latter part of the nesting season. Fledging success for specific sites is always categorized by nest location, even in cases where broods move to adjacent areas before fledging. In 2013, we recorded the longitude and latitude of all nests with Global Positioning Units. These locations are depicted in Appendices 1-12. Monitoring is conducted under U. S. Fish and Wildlife Service Permit TE 807078-15.

MANAGEMENT

A variety of techniques are used to improve the breeding success of the Snowy Plover in the study area. The upper beach at Salinas River NWR and the salt ponds are closed to the public to protect nesting plovers from human disturbance. On California state beaches symbolic fencing, consisting of signed,

roped-off upper beach areas, is used to protect most nests (Table 1) and limit human disturbance of brood rearing birds during the nesting season.

Whereas 10 foot by 10 foot nest exclosures, made of 2-inch-wide by 4-inch-tall wire mesh fencing, standing 5-feet-high and 10 feet-long on each side, have been used extensively in the past to protect nests from predators, their widespread use in the Monterey Bay area has been limited in recent years because of the effectiveness of a mammalian predator removal program conducted by USDA. No exclosures of this type were used in 2013 and only 5 circular mini exclosures, 24-36 inches in diameter and 24 inches high, were used to protect nests from predators in 2013. In some years we have also used gull exclosures –symbolically fenced exclosures with a few lengths of cord stretched over the top that surrounds individual nests – only two of these were used in 2013.

We continued to manage water levels at the Salt Ponds to create dry nesting substrate and associated wet foraging areas for Snowy Plovers. Water is drawn down rapidly from some ponds at the beginning of the season to provide dry nest sites. Thereafter, flooding of remnant-wet areas is undertaken several times per month throughout the nesting season to maintain foraging habitat for adults and chicks.

Table 1. Nest protection measures for Snowy Plovers at Monterey Bay in 2013.

Location	Total Nests	10 X 10 Excl. Only	Min Excl. Only	Symb. Fence Only	Fence & Mini Excl.	Fence & 10 X 10 Excl.	Fence & Gull Excl.	Sign Only	Found Broods Only
Del Monte	0								
Sand City	2			2					
Fort Ord	18			18					
Reservation Road	19			19					
Marina									
Marina South	11			11					
Marina Middle	25			25					2
Marina North	14			14					1
Martin	11			11					1
Salinas River NWR	56			56					4
Salinas River North									
Salinas River N. Spit	26			26					4
Monterey Dunes	24			24					1
Molera/Potrero	28			28					2
Jetty to Beach Roads									
Moss Landing	57			57					
Zmudowski Beach	47			43	4				1
N. Pajaro R.M.	89			88	1				
Sunset/Manresa	17			17					1
Salt Ponds	38			36			2		
Total	482	0	0	475	5	0	2	0	17

RESULTS

The 2013 Nesting Season

Number of Breeders

We estimated that 382 plovers nested in the Monterey Bay area in 2013, a similar number to the previous year (Fig. 1) and a 13% greater number than the 338 target recommended for the Monterey Bay area in the USFWS Recovery Plan. The 2013 nesters consisted of 199 males and 183 females. Ten of the males and 17 of the females were unbanded. Among the remaining 189 uniquely color marked male breeders were 15 birds produced from nesting attempts in the Monterey Bay area in 2012. Among the 166 uniquely marked female nesters were 30 produced from nesting attempts in the Monterey Bay area in 2012. No plovers were detected nesting on the northern Santa Cruz County pocket beaches in 2012 (Table 2).

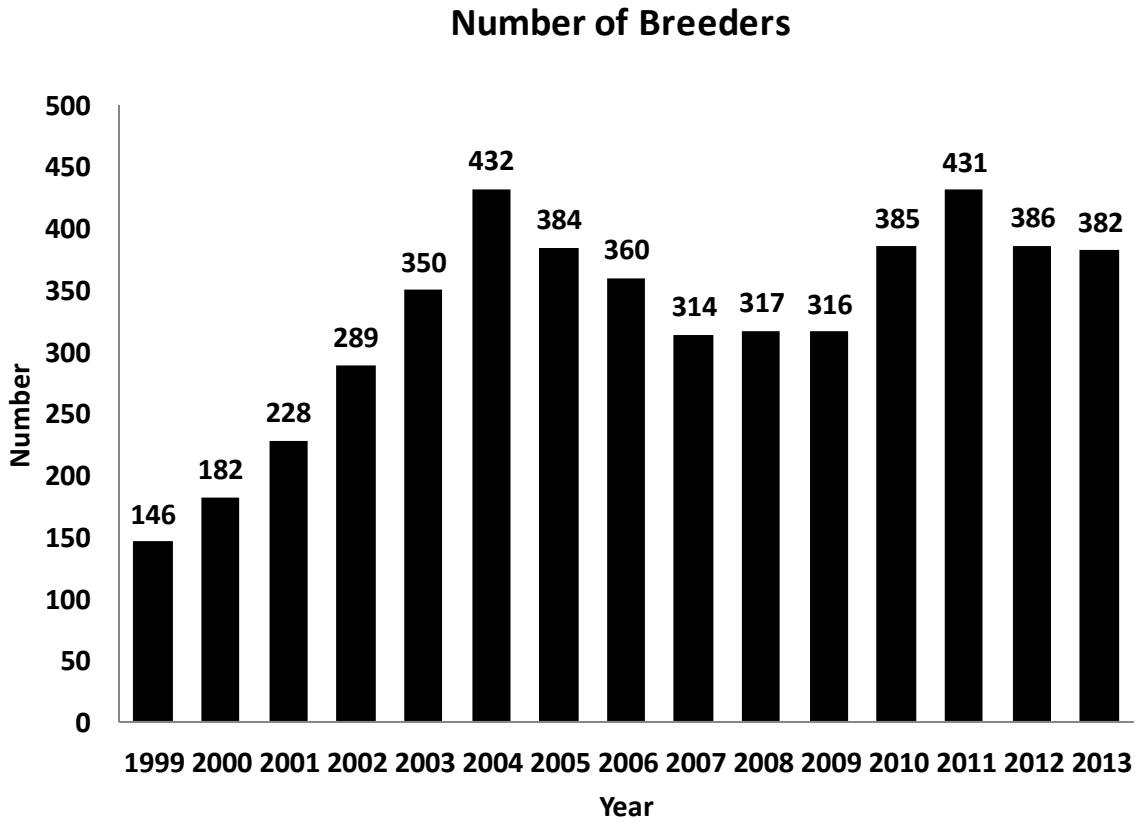

Figure1. Number of nesting Snowy Plovers at Monterey Bay, 1999-2013.

Return Rates

Return rates of breeders were slightly above average in 2013. Of adults that nested in 2012, 72% of both males and females returned and bred in 2013. This compares with average return rates of 68% for males and 63% for females in the prior 14 years (Fig. 2).

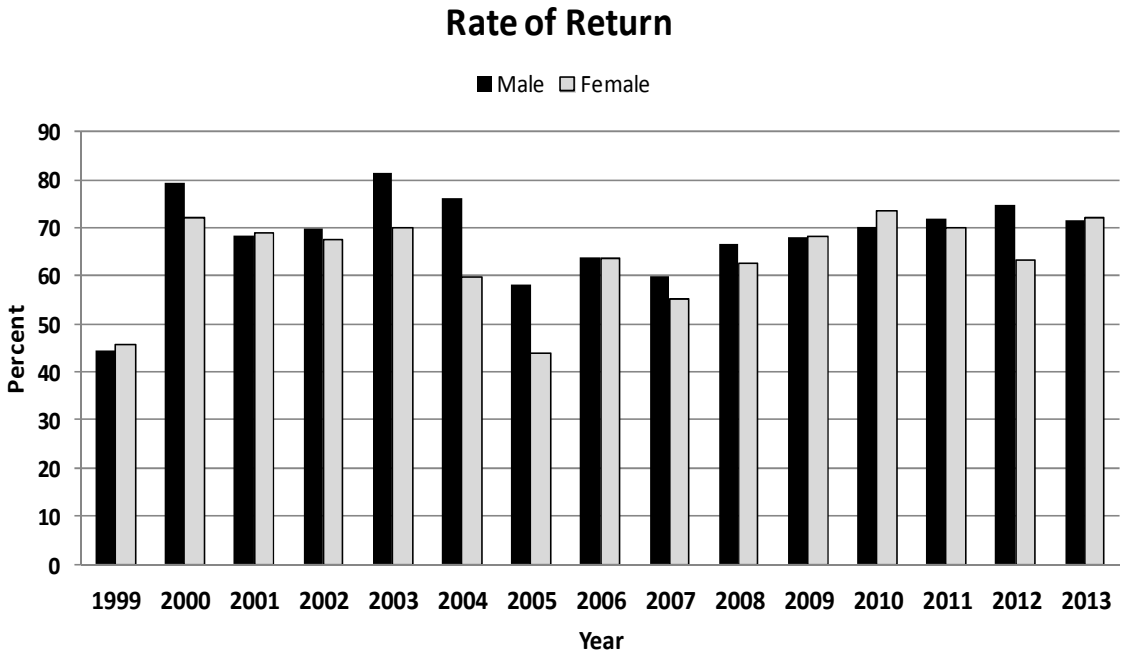

Figure 2. Return rates of nesting Snowy Plovers at Monterey Bay.

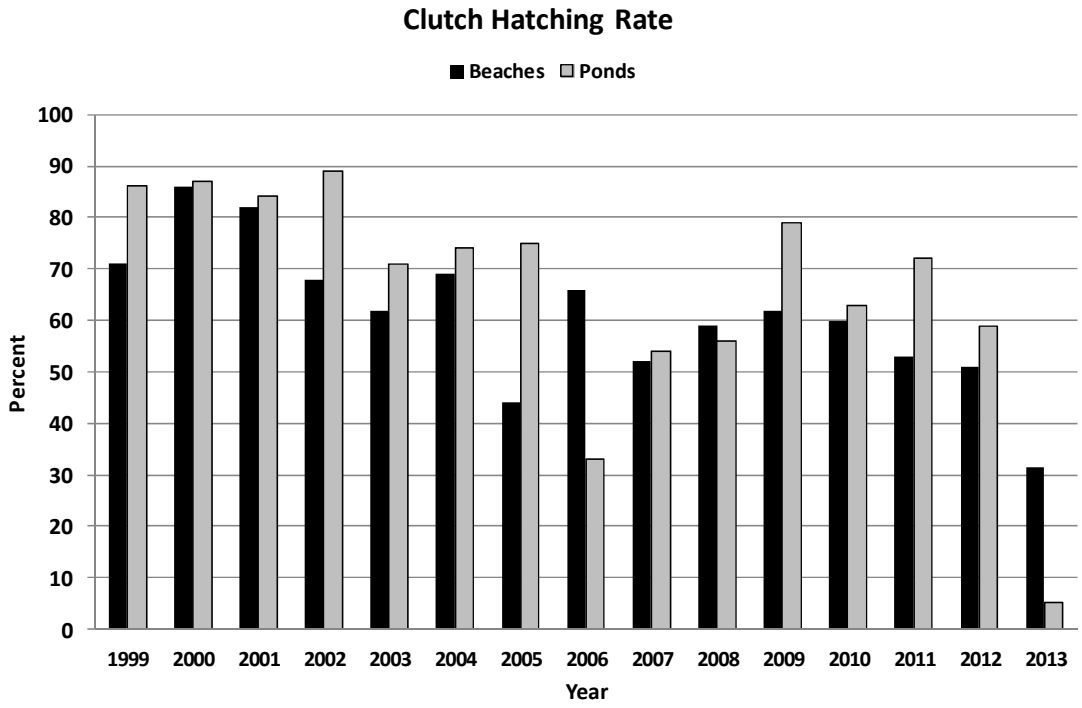

Figure 3. Clutch hatching rates of Snowy Plovers at Monterey Bay.

Clutch Hatching Rates

We found 482 nests and 17 broods from undetected nests indicating at least 499 nesting attempts in the Monterey Bay area in 2013 (Table 2). Our calculations of the clutch hatching rates of these nests exclude all nesting attempts documented only from the detection of broods.

The 2013 hatching rate of clutches on the beaches and at the salt ponds was substantially below their respective averages from 1999-2012. The 31.5% hatching rate on the beaches was 50% below the 63% average of the previous 14 years and the salt pond rate of 5.3% was 92% below the 70% average of the previous 14 years (Fig. 3). Below average hatching rates were widespread, occurring at all locations with ≥ 10 nesting attempts except Fort Ord and Reservation Road (Table 2).

Table 2. Breeding success of Snowy Plovers at Monterey Bay in 2013. Juv. is Juvenile and Att. is Attempt.

	Nest Attempts		Chicks			% Nests	% Chicks Fledge		Juv. Per	Hatch
Regions	Nests	Broods	Low	High	Juv.	Hatch	High	Low	Nest Att.	Nests
Del Monte-Res. Rd.										
Sand City	2	0	6	6	3	**100.0**	**50.0**	**50.0**	**1.50**	2
Fort Ord[1]	18	0	31	34	10	**72.2**	**32.3**	**29.4**	**0.56**	13
Reservation Road	19	0	40	44	7	**84.2**	**17.5**	**15.9**	**0.37**	16
Marina										
Marina South	11	0	12	12	4	**36.4**	**33.3**	**33.3**	**0.36**	4
Marina Middle	25	2	28	29	12	**32.0**	**42.9**	**41.4**	**0.44**	8
Marina North	14	1	13	15	5	**35.7**	**38.5**	**33.3**	**0.33**	5
Martin	11	1	7	9	1	**18.2**	**14.3**	**11.1**	**0.08**	2
Salinas NWR	57	3	37	44	21	**26.3**	**56.8**	**47.7**	**0.35**	15
Salinas River N										
N. Salinas River	25	5	47	53	19	**56.0**	**40.4**	**35.8**	**0.63**	14
Monterey Dunes	24	1	30	32	14	**41.7**	**46.7**	**43.8**	**0.56**	10
Molera/Potrero	28	2	16	18	4	**21.4**	**25.0**	**22.2**	**0.13**	6
Jetty-Beach Rds.										
Moss Landing	57	0	54	54	3	**35.1**	**5.6**	**5.6**	**0.05**	20
Zmudowski Beach	47	1	22	24	8	**19.1**	**36.4**	**33.3**	**0.17**	9
Pajaro Spit	89	0	41	41	4	**18.0**	**9.8**	**9.8**	**0.04**	16
Sunset/Manresa	17	1	1	3	1	**0.0**	**100.0**	**33.3**	**0.06**	0
TOTAL BEACHES	**444**	**17**	**385**	**418**	**116**	**31.5**	**30.1**	**27.8**	**0.25**	**140**
SALT PONDS	**38**	**0**	**5**	**5**	**0**	**5.3**	**0.0**	**0.0**	**0.00**	**2**
GRAND TOTAL	**482**	**17**	**390**	**423**	**116**	**29.5**	**29.7**	**27.4**	**0.3**	**142**

Table 3. Total Snowy Plover clutches lost and percent attributed to different causes from 1999 to 2013. Unk. is unknown.

Year	Total Nest Losses	Mammal Predator	Avian Predator	Unknown Predator	Human	Wind Tide Rain	Desertion	Non-Viable	Unk. Cause	Lost at Hatch	Unk Fate
1999	**31**	13	3	13	6	23	29	13	0	0	0
2000	**27**	0	19	26	0	15	30	11	0	0	0
2001	**51**	2	45	6	4	2	22	8	12	0	0
2002	**87**	13	39	2	3	17	17	1	7	0	0
2003	**91**	10	25	4	1	9	13	3	34	0	0
2004	**129**	6	23	12	8	20	11	2	19	0	0
2005	**216**	16	47	5	3	9	6	1	14	0	0
2006	**123**	33	12	25	0	10	9	2	9	0	0
2007	**162**	12	37	14	2	10	10	5	9	0	0
2008	**138**	11	37	20	1	17	1	4	7	2	0
2009	**113**	11	33	9	2	19	4	11	12	0	0
2010	**153**	8	18	22	3	20	9	3	16	1	0
2011	**193**	8	33	16	1	11	11	1	20	0	0
2012	**197**	2	40	14	4	9	6	0	25	0	0
2013	**340**	7	36	20	0	4	3	0	28	1	0
Mean	**137**	**10**	**30**	**14**	**3**	**13**	**12**	**4**	**14**	**0**	**0**

At least 63% of the 340 nest losses in 2013 were likely caused by predators (Tables 3 and 4). Of the 215 losses attributed to predators, 57.7% were attributed to avian predators, 11.2% to mammalian predators and 31.2% to unknown predators. Ravens, harriers, gulls and Red-tailed Hawks were the avian species identified depredating nests (Table 4). Nest depredation by ravens was widespread, occurring at 11 of 17 locations (Table 4). On camera, ravens were recorded taking 5 nests in the salt ponds. Overall, 43 nest losses were attributed to ravens.

Northern Harriers were implicated in the loss of at least 11 nests including 4 losses captured on camera at the salt ponds. Harriers and ravens were likely responsible for much of the nest loss in the Moss Landing to Pajaro River areas and possibly outer beach areas as far south as Marina. Our cameras also documented the only nest loss attributed to Red-tailed Hawks -- at the salt ponds.

Skunks, canines, and raccoons were responsible for 22 of the 24 nest losses attributed to mammalian predators (Table 4). Three nests categorized as lost at hatch were undoubtedly also destroyed by avian or mammalian predators but we could not be sure if the losses occurred in the egg or chick phase.

Among nest losses attributed to other causes were 1 nest destroyed by humans and 15 by natural elements such as wind, tide and rain (Table 4). Ten nests were deserted and 1 had non-viable eggs.

No cause of loss could be attributed 27.6% of the 340 nests that failed but most of these were probably taken by predators rather than other causes listed in table 4. The fate of only one nest was categorized as unknown.

Table 4. Causes of Snowy Plover nest loss at Monterey Bay in 2013. Unk. is Unknown, and Pred. is Predator.

	Avian Predator						Mammalian Predator				Unk.					Non-		Cause	Lost at	Fate	
Locations	**CORA**	**WHIM**	**Gull**	**NOHA**	**RTHA**	**Unk.**	**Canine**	**Skunk**	**Racoon**	**Unk.**	**Pred.**	**Human**	**Tide**	**Wind**	**Rain**	**Viable**	**Desert.**	**Unk.**	**Hatch**	**Unk**	**Total**
Del Monte																					0
Sand City																					0
Fort Ord							1						1			1	1			1	5
Reservation Road							3														3
Marina South	1					3								2				1			7
Marina Middle	8					5	1				1							2			17
Marina North	6					1												2			9
Martin	3					5					1										9
Salinas NWR						4	2	3			16	1		1			2	11	2		42
N. Salinas River	2					2					5			1			1				11
Monterey Dunes	4					7							1					2			14
Molera/Potrero	1					8					3		1					9			22
Moss Landing						7	1				10		1	2			1	15			37
Zmudowski Beach	5		2			6					10		1	2			1	11			38
Pajaro River Spit	8		1	6		14		7	1	2				1			3	29	1		73
Sunset/Manresa	1								3					1				12			17
Salt Ponds	4			5	1	4					21						1				36
Total	**43**	**0**	**3**	**11**	**1**	**66**	**8**	**10**	**4**	**2**	**67**	**1**	**5**	**10**	**0**	**1**	**10**	**94**	**3**	**1**	**340**

Chick Fledging Rates

Chick fledging rate was also considerably below average on the beaches and in the ponds in 2013. On the beaches, only 28-30% of the chicks fledged in 2013 (Table 2). This rate was about 30% below the average of 41.5% from 1999-2012 (Fig. 4). None of the five chicks that hatched at the salt ponds fledged (Fig. 4) but little can be interpreted from the salt pond rate because the sample size of chicks is so low.

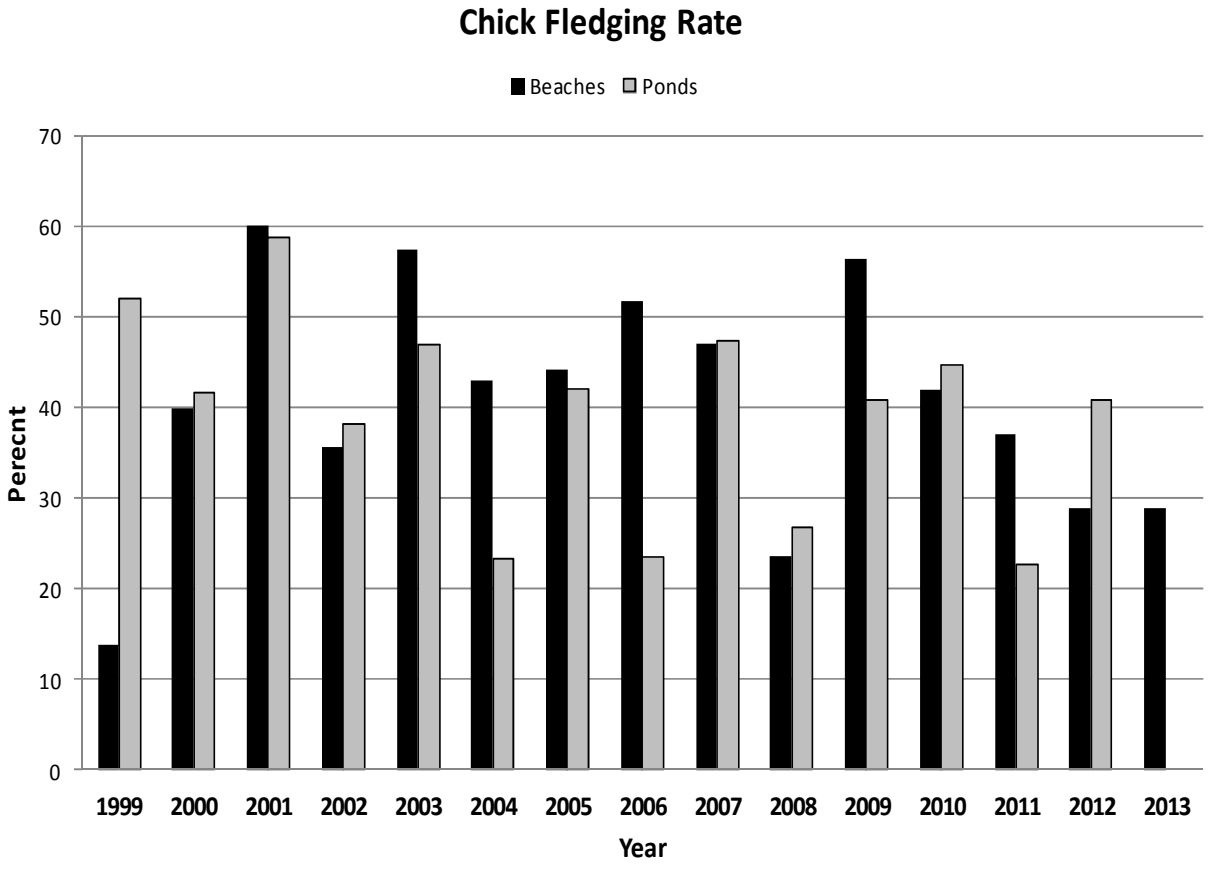

Figure 4. Chick fledging rates of Snowy Plovers at Monterey Bay.

Number of chicks fledged

All 116 young that fledged in 2013 were from the beaches and most came from the south bay (Table 2). The total number of fledged young in 2013 was 51% below the 236-bird average from 1999-2012 and marked the fourth year of decline since 2009 (Fig.5). The number of fledglings from the beaches was 37% below the prior 13-year 185-bird average. On average 49 chicks have fledged in the salt ponds since 1999 but none of the 5 chicks hatched at the ponds fledged in 2013.

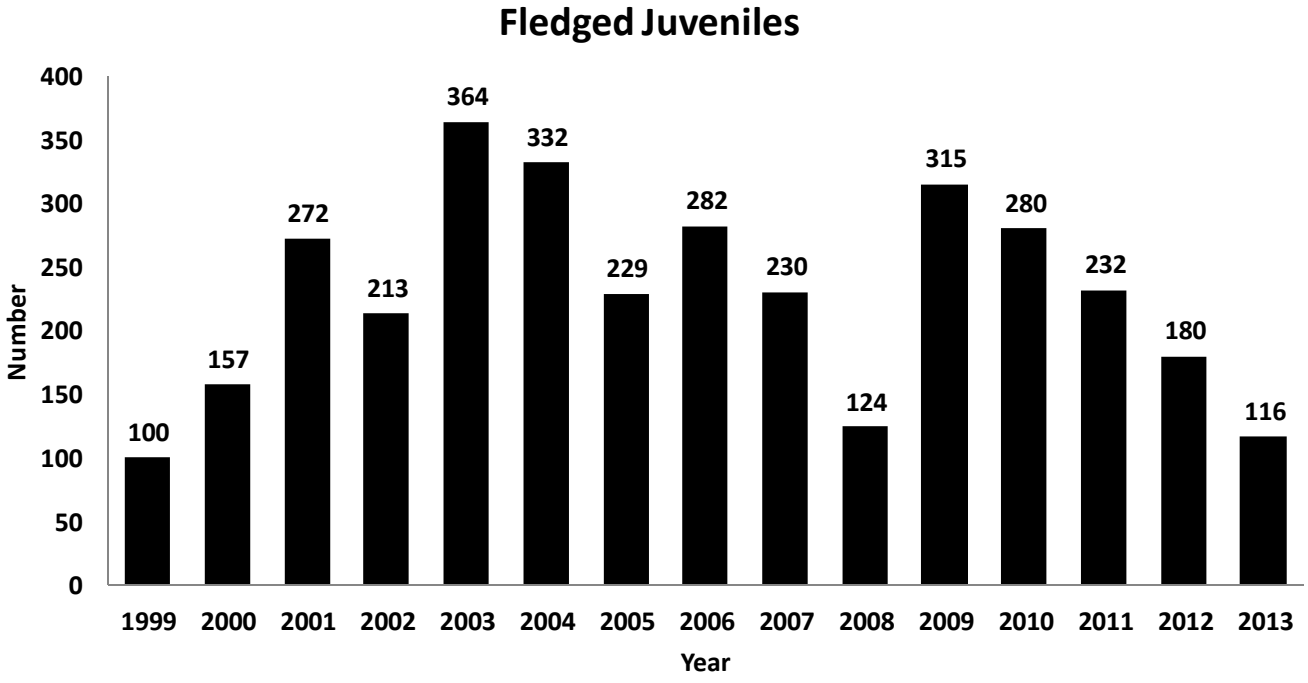

Figure 5. Number of fledged juveniles at Monterey Bay.

Young Fledged Per Male

The 2013 fledging rate of 0.58 young per male was 59% lower than the 1.4 bird average of the past 13 years (Fig. 6), was the fourth year of a steady decline (Fig. 6), and was well below the level of one young per male needed to prevent the population from declining (USFWS Recovery Plan).

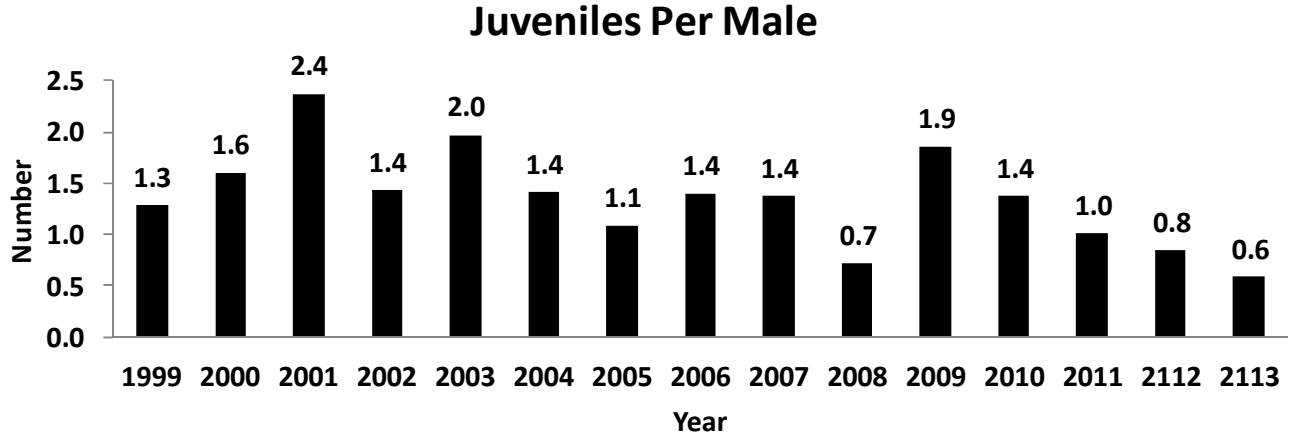

Figure 6. Mean number of juveniles reared per male at Monterey Bay.

DISCUSSION

Our estimate of 382 breeding Snowy Plovers in the Monterey Bay region is likely a little low as some birds may have lost all their nests before we were able to associate the bird with any of them. This possibility is especially likely in years such as this one when many nests are lost early in the incubation period. Despite this, the 382 confirmed breeders in 2013 exceeded the target of 338 adults for the Monterey Bay region recommended by the USFWS. This target has been exceeded in the Monterey Bay area in 8 of the 11 years since it was first attained in 2003. Although the number of breeders in the Monterey Bay area dipped slightly below the 400-bird target for all of USFWS Recovery Unit 4 – all coastal nesting areas from Sonoma through Monterey counties – when breeders from other areas within unit 4 are accounted for (18 at Point Reyes and 2 at Stinson Beach) the population for the entire recovery unit reached its 400-bird target.

The USFWS window survey in late May is the only method of estimating the relative size of the entire U.S. Pacific coast population from year to year. Our data continue to suggest that this method underestimates the number of breeders in the Monterey Bay region. In 2013, 245 adults were detected in the study area on the window survey. This represents only 64% of the estimated 382 adults (mainly color banded birds) known to have nested in the study area.

Plovers experienced another year of subpar breeding success in the Monterey Bay area in 2013. Clutch hatching rate was 54% and chick fledging rate 31% below the prior 14-year average. As a result, the total of 116 fledges was 51% lower than the average of the prior 14 years. The consequence of the low number of fledglings produced in 2013 will likely be a smaller breeding population in the Monterey Bay area in 2014. One fledged young per male is necessary to sustain a population experiencing average mortality levels but only 0.6 chicks per male fledged in 2013.

At Monterey Bay below average hatching rates were widespread, occurring at all locations with ≥ 10 nesting attempts except Fort Ord and Reservation Road (Table 2). Depredation of clutches by avian predators was the prominent identified cause of this nest failure. At the salt ponds cameras verified 5 cases of clutch depredation by Northern Harriers, 4 by Common Ravens, and 1 by a Red-tailed Hawk (Table 4). At the Pajaro spit, an individual harrier and a pair of ravens were observed depredating plover nests. Overall, avian predators were responsible for at least 36.5% of the 340 nest losses. Many of 67 additional losses attributed to unknown predators and 94 nesting failures for which no cause of loss could be assigned were likely caused by avian predation as well. Only 24 nest losses were attributed to mammalian predators in 2013. Three areas hatching ≥ 10 chicks exhibited very low chick fledging rates: Moss Landing (5.6%); Pajaro Spit (9.8%), and Reservation Road (15.9-17.5%). It is rare to observe actual chick depredation but we speculate that avian predators were also largely responsible for the high levels of chick loss.

On the Pacific coast, the Snowy Plover has become a management-dependent species requiring provision of undisturbed nesting areas and protection from predators to be a successful breeder. Monitoring plover nests and broods is an important component of a management program because it identifies where and when plovers are experiencing breeding problems so that management actions can be directed to where they are most needed. We plan to continue exploring the use of cameras to assist in the identification of nest predators and other causes of nest loss.

RECOMMENDATIONS

The following is a summary of current and proposed management actions for all Monterey Bay beaches. Actions are briefly summarized in Table 5.

Wilder, Laguna, Scott Creek, and Waddell Creek Beaches
While no nests have been found on these beaches since 2009, snowy plovers are regularly seen during the breeding season, particularly in spring. More frequent surveys of Scott Creek, and other northern Santa Cruz County beaches, are needed to properly assess nesting activity. Enforcement of beach rules and regulations is greatly needed.

Management actions:

1) Symbolic fence maintenance (Scott Creek)
2) Enforcement of dog prohibition (Scott Creek)
3) Twice weekly plover nesting surveys, particularly March through May
4) Twice weekly predator surveys

Salt Ponds (Moss Landing Wildlife Area) – Clutch hatching success was extremely low; Northern Harriers, Common Ravens and Red-tailed Hawks were identified as primary nest predators. The ponds may not be providing adequate cover. Pond floors are largely devoid of vegetation, as pickleweed (*Salicornia* sp.) has not regenerated at the rate expected since the completion of restoration activities. Very limited shell debris did not afford adequate cover from aerial predators.

Management actions:

1) Trap and relocate up to 2 Northern Harriers at Moss Landing Wildlife Area.
2) Increase monitoring of diurnal predator activity.
3) Limited, experimental planting of vegetative cover (e.g. *Distichlis spicata*).

Sunset State Beach – At least 3 nests were taken by raccoons and their tracks were commonly observed in the plover nesting area south of the day use area. Common ravens were observed very frequently and were also documented to be responsible for 1 depredated nest. Historically, skunk depredation of nests has been a problem at Sunset.

Management actions:

1) Initiate skunk and raccoon trapping early in the nesting season at the pond area east of the main dunes at Sunset State Beach (south of the main day use area).

2) Explore the option of Common Raven management at north Sunset during the early season by State Parks rangers using methods similar to those being used at Big Basin State Park. The northern beaches are much less used by humans than the southern beaches and human beach use is lower early in the season than in the mid and later summer.

Pajaro River mouth (northern river spit and north to Palm Beach) – Common Ravens and Northern Harriers were the primary predators responsible for most early and mid season nest losses. Skunks were responsible for many late season nest losses at the northern end of the symbolically fenced area at the river spit. Skunks were not targeted for removal until very late in the nesting season. Based on tracks, Great-horned Owls were present in the nesting area for most of the season and may have contributed to chick loss. The numbers of dogs off leash encountered (39) greatly exceed the number of dogs on leash (11), which may have contributed to low fledge rates. To the north of the spit and in front of the Pajaro Dunes houses, trespass through symbolically fenced areas was very high as evidenced by observations of violations in progress, and by human tracks. Much of the violation occurred from the house side as beach users took short cuts to access the beach (i.e. did not use access stairs). In one case a nest was almost stepped on.

Management actions:

1) Trap and relocate up to 2 Northern Harriers at Zmudowski SB/north Pajaro River.
2) Trap and relocate up to 2 owls at Zmudowski SB/north Pajaro River.
3) Initiate skunk removal at the north end of Pajaro spit in the early nesting season.
4) Develop a joint State Parks/ Pajaro Dunes integrated skunk management strategy.
5) Consider installation of predator exclusion fence at north end of Pajaro Spit nesting area to prevent skunks from crossing into nesting area from beneath condominiums adjacent to the river spit.
6) Increase State Park ranger patrols to improve compliance with leash law in front of Pajaro Dunes houses and compliance with dog prohibition on Pajaro river spit.
7) Symbolically fence and install signs on the eastward side of fenced areas in front of the Pajaro Dunes houses to prevent trespass into nest area. Alternatively, consider leaving these areas unfenced in order to discourage nesting in this area.

Zmudowski and Moss Landing State Beaches – Ravens were documented taking 5 nests at Zmudowski SB and a Northern Harrier was the suspected cause of loss of 8 nests at these sites, based on timing and evidence at lost nests. Owl tracks were noted throughout Zmudowski SB suggesting a regular presence. Horse use was not effectively restricted to the wet sand and may have impacted brood survival. Trespass (OHV, pedestrian, dog) was prominent at Zmudowski SB and at the "Foster" access. Needed cable fencing maintenance exceeded capacity of available personnel throughout the nesting season.

Management actions:

1) Trap and relocated up to 2 harriers at Zmudowski SB/north Pajaro River.
2) Trap and relocate up to 2 owls at Zmudowski SB/north Pajaro River.
3) Increase enforcement to improve equestrian compliance with horse regulations.
4) Devote more State Park staff time to maintenance of cable fencing.
5) Continue *Ammophila* removal.

Molera through Potrero Road (Salinas River State Beach) – Equestrian use in this area continues to have a heavy impact to nesting habitat. The major identified nest predator was Common Raven.

Management actions:

1) Improve raven control
2) Increase enforcement to improve equestrian compliance with horse regulations.

Monterey Dunes Colony – The major identified nest predator was Common Raven which was identified as taking 4 nests. There was a high level of trespass within fenced habitat areas, a lot of which came from the east (house) side. A nest and a brood were almost stepped on. Residents persist in taking dogs onto beach from houses in violation of dog prohibition.

Management actions:

1) Symbolically fence and install signs on the eastward side of vulnerable fenced areas in front of the Monterey Dunes houses.
2) Conduct outreach to MDC management and residents regarding dog prohibition on beaches.

North Salinas (Salinas River State Beach) – Avian predators were responsible for 4 of the 9 predator nest losses in this area. Common ravens were confirmed taking 2 of the 4 nests attributed to avian predators and control of their population is necessary for continued plover nesting success. This area just north of and adjacent to the Salinas river mouth is a natural preserve that, except for the outer beach area, is closed to pedestrian access during the Snowy Plover nesting season. Fisherman and beach-goers accessing the outer beach and lagoon area via the Scatini farm property continue to disturb birds as they pass through the closed nesting area. Nests and chicks are at risk of being stepped on. Especially problematic this past year was a consistent user who accessed the beach and river bank off of the levee and would let two large dogs run off leash in the closed area along the north end of the lagoon. The river mouth stayed closed this year which provided good foraging habitat and eventually cover for broods and nesting birds. When possible, coordinating with all of the agencies to have breaching occur at the earliest possible date or not breaching at all may be beneficial.

Management actions:

1) Repair the back gate on the levee at the corridor entrance to prevent pedestrian and vehicle trespass into the closed nesting area.
2) Ensure that the symbolic fencing and closed nesting area signs are up on the boundary of the Scatini farm and State Park property.
3) Install new signage at the end of the symbolic fence line when the river mouth is open to the ocean to alert the public of the river mouth closure. These were used last year in the Santa Cruz District at the Pajaro River mouth -- “Attention: Do not go past this point. Area between river and cable fencing is closed to protect snowy plover nesting habitat. Entering this area may result in citation.”

4) Increase patrols of the Salinas River levee by State Parks rangers to improve compliance with the closure of the nesting area.

Salinas River National Wildlife Refuge – Most notable in 2013 was the consistent presence of skunks in the nesting area. While only 3 nests were confirmed taken by skunks, they were suspected in many of the 16 unknown predator losses. Also noted was an increased presence of coyotes which may or were responsible for the two nests lost to canines, for brood failures, and may possibly be the cause of the failure of the Caspian tern colony. More data on their activities will be collected by Point Blue personnel. Northern harriers were confirmed nesting in the vegetation about half way between the river and the lagoon. At the north end of the main beach, fisherman consistently trespassed into the closed area to fish in the river mouth lagoon because there were rumored to be striped bass trapped there. Several nests were nearly stepped on by these fisherman and their dogs. The broods foraging at the lagoon edge were potentially also affected.

Management actions:

1) Initiate skunk trapping in the early nesting season.

2) Monitor harrier nesting patterns beginning in late March and determine management actions based on overall bay-wide activity.

3) Maintain the "no dog" signs at the kiosk and on the entrance gate as they get vandalized throughout the season.

4) Install new signage at the end of the symbolic fence line when the river mouth is open to the ocean to alert the public of the river mouth closure. These were used last year in the Santa Cruz District at the Pajaro River mouth -- "Attention: Do not go past this point. Area between river and cable fencing is closed to protect snowy plover nesting habitat. Entering this area may result in citation."

5) Increase patrols by Refuge law enforcement officers to improve compliance with the closure of the nesting area.

Martin Dunes and Marina (Cemex) – The major identified nest predator was Common Raven.

1) Improve raven control.

Reservation Road and Fort Ord

1) Increase enforcement of dog prohibition on beaches and closed nesting areas

Sand City and Monterey State Beach

1) Increase enforcement of dog prohibition on beaches and closed nesting areas

Table 5. Summary of existing and proposed management actions at Monterey Bay beaches

	Actions *c = current, p = proposed new action or increase in current levels*							
Location	symbolic fencing	monitoring	habitat enhancement	predator exclosures	predator management	enforcement	outreach/engagement	**Brief Synopsis**
Del Monte	c	p	p			p		
Sand City	c	p	p					
Fort Ord	c	c				p		
Reservation Rd	c	c				p		
Marina (Cemex)	c	c	p		p			
Martin	c	c	p		p			
SRNWR	c	c	c		p	p	p	*early season skunk control; coyote exclusion fencing*
N Salinas	p	c	c		c	p	p	*repair gate at corridor; maintain and sign fencing at Scatini/State Park boundary*
Monterey Dunes	p	c			c	p	p	*fence rear sections of vulnerable habitat areas*
Molera/Potrero	p	c	p		p	p	p	*increased equestrian compliance*
Moss Landing	p	c	c		c	p	p	*fence maintenance; increased equestrian compliance*
Zmudowski	p	c	c	c	p		p	*fence maintenance; cameras; relocate owl; increased equestrian compliance*
Pajaro R.M.	p	c		p	p	p	p	*fence rear sections of north pajaro habitat areas; predator exclusion fence at pajaro spit; dog prohibition compliance*
Sunset	c	c			p			*early season predator control at pond area east of main Sunset dunes*
Salt Ponds	c	c	p		p		p	*increase vegetative cover; relocate harrier; increased predator observation*
Seabright								
Wilder	c	p			p			*2x weekly monitoring*
Laguna Cr	c	p			p			*2x weekly monitoring*
Scott Cr	c	p	p		p	p	p	*2x weekly monitoring; iceplant removal*

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Appendix 1. Overview of Snowy Plover nest locations in the Monterey Bay area in 2013.

Appendix 2. Snowy plover nest locations at the northern section of Sunset State Beach in 2013. This map does not include1 nest that was found as a brood.

Appendix 3. Snowy plover nest locations at the Pajaro Spit at Sunset and Zmudowski State Beaches in 2013.

Appendix 4. Snowy plover nest locations at Zmudowski State Beach in 2013. This map does not include 1 nest that was found as a brood.

Appendix 5. Snowy plover nest locations at Jetty Road at Zmudowski and Moss Landing State Beaches in 2013.

Appendix 6. Snowy plover nest locations at the Moss Landing Wildlife Management Area in 2013.

Appendix 7. Snowy plover nest locations at the northern portion of Salinas River State Beach in 2013. This map does not include 2 nests that were found as broods.

Appendix 8. Snowy plover nest locations at the southern portion of Salinas River State Beach in 2013. This map does not include 5 nests that were found as broods.

Appendix 9. Snowy plover nest locations at the Salinas River National Wildlife Refuge and the Martin dunes in 2013. This map does not include 5 nests that were found as broods and 1 nest that was collected by a member of the public.

Appendix 10. Snowy plover nest locations at Marina beach in 2013. This map does not include 3 nests that were found as broods.

Appendix 11. Snowy plover nest locations at Marina State Beach in 2013.

Appendix 12. Snowy plover nest locations at Fort Ord Dunes State Park and Sand City in 2013.